THE TAXONOMY OF THE SPECIES COMPLEX, STREPTANTHUS GLANDULOSUS HOOK.

A. R. Kruckeberg[1]

The taxonomic delimitation of species and their infraspecific elements by experiment has nurtured a vigorous renaissance in biological taxonomy. Nevertheless, taxonomic revision has not been the sole objective of experimental studies of wild populations. Often, a revision may be merely a useful by–product of a study aimed at other objectives. The present review of the taxonomy of *Streptanthus glandulosus* Hook. came into being in such a fashion.

While investigating the extent of genetic isolation between certain populations of the central Californian serpentine species, *Streptanthus glandulosus,* the author discovered that genetic isolation between some populations was complete and between others only partial. Moreover it was observed that complete genetic isolation for such populations was often correlated with their geographic isolation and morphological distinctness. Here then were available three basic criteria for the demarcation of species. The presence of discontinuities in the variation pattern of *S. glandulosus* permits treating these biologically isolated populations as taxonomic entities. The experimental evidence for the taxonomic disposition of the members of the complex as species or subspecies is reported in detail elsewhere (Kruckeberg, 1957).

The taxonomy of the entities comprising the *Streptanthus glandulosus* complex has had a complicated history. The Hooker epithet of *S. glandulosus* was applied to plants collected by Douglas in California and remained the only taxon for the group until the time of E. L. Greene. Greene described twelve species within the *glandulosus* pattern of variation, eleven of which he placed in a new genus, *Euclisia* (Greene, 1906). Adopting more conservative views, Jepson (1925, 1936) and Abrams (1944) recognized only three species in the complex: *Streptanthus glandulosus* with two varieties [var. *albidus* (Greene) Jeps., and var. *pulchellus* (Greene) Jeps.], *S. niger* Greene, and *S. secundus* Greene. A recent reevaluation of *S. glandulosus* is found in an unpublished monograph of the section *Euclisia* by Morrison (1941). He recognized as the subsection *Pulchelli* of the section *Euclisia,* two species, *S. glandulosus* and *S. Coombsae* Eastwood. Morrison defined *S. glandulosus* broadly to include five subspecies: *"typicus," albidus, niger, pulchellus,* and *secundus.* This treatment of the complex accounted for the taxa recognized by Greene by treating certain of them as infraspecific elements of a polymorphic species complex and by relegating others to synonomy.

[1] A portion of this study was financed by grants from the state of Washington initiative No. 171 and the National Science Foundation.

Madroño, Vol. 14, No. 7, pp. 217–248, July 18, 1958.

Very little is known about *Streptanthus Coombsae,* since it has not been collected subsequent to its discovery in 1913 by Mrs. A. L. Coombs. Eastwood (1931) cited it as being collected "on the Williamson River, Southern Oregon." The only river in Oregon by this name is in the arid sagebrush country east of the Cascade Range in Klamath County, a most unlikely habitat for members of the section *Euclisia,* most of which occur on serpentine outcrops in cismontane California. However, members of the section *Euclisia* do occur in southwestern Oregon, growing on serpentine areas in Josephine County. *Streptanthus Coombsae* is not dealt with further in the present paper.

The present revision of the *Streptanthus glandulosus* complex is based on the premise that the degree of taxonomic relationship may be inferred from the degree of compatibility between different populations or from fertility of interpopulational hybrids. Accordingly, the taxonomic implications of hybrid fertility have been evaluated for over 300 artificial crosses involving 32 different population samples of the *S. glandulosus* complex in various combinations. The results and implications of this analysis were published by the author (Kruckeberg, 1957). Three of the eight taxa recognized here are regarded as species. These are *S. niger* Greene, *S. albidus* Greene, and *S. glandulosus* Hooker. In the previous treatments of Jepson, Abrams, and Morrison, *S. albidus* has been regarded as an infraspecific element of *S. glandulosus*. However, the sharp genetic discontinuity between *S. albidus* and all other populations, coupled with the morphological distinctness and regional restriction of *S. albidus* warrant the restoration of this Greeneian species. Similar justification can be made for the recognition of *S. niger,* a species of very narrow serpentine restriction. *Streptanthus glandulosus* is here taken as the most widespread and polymorphic of the three species. It occurs discontinuously and mainly on serpentine from Josephine County, Oregon to San Luis Obispo County, California. Three subspecies of *S. glandulosus* are recognized on the basis of more or less well–delimited morphological discontinuities and geographic range, coupled with high average inter– and infrasubspecific fertilities in interpopulational hybrids. They are *S. glandulosus* subsp. *glandulosus,* subsp. *pulchellus,* and subsp. *secundus* (with three varieties). Figure 1, taken from Kruckeberg (1956), summarizes the interrelationships of the major taxa constituting the *S. glandulosus* complex.

The elements taken here as constituting the *Streptanthus glandulosus* complex can be distinguished from other members of the section *Euclisia* by a particular ensemble of characteristics. The leaves are narrowly lanceolate and sinuately toothed to pinnatifid. The herbage is usually pubescent at least in the rosette stage, often densely hispid (*S. niger* is the only exception, with consistently glabrous and glaucous foliage). In contrast to the "color–spot" species where the terminal flowers of the raceme are sterile and their sepals highly colored and elongated, the members of the *S. glandulosus* complex produce solely fertile flowers which

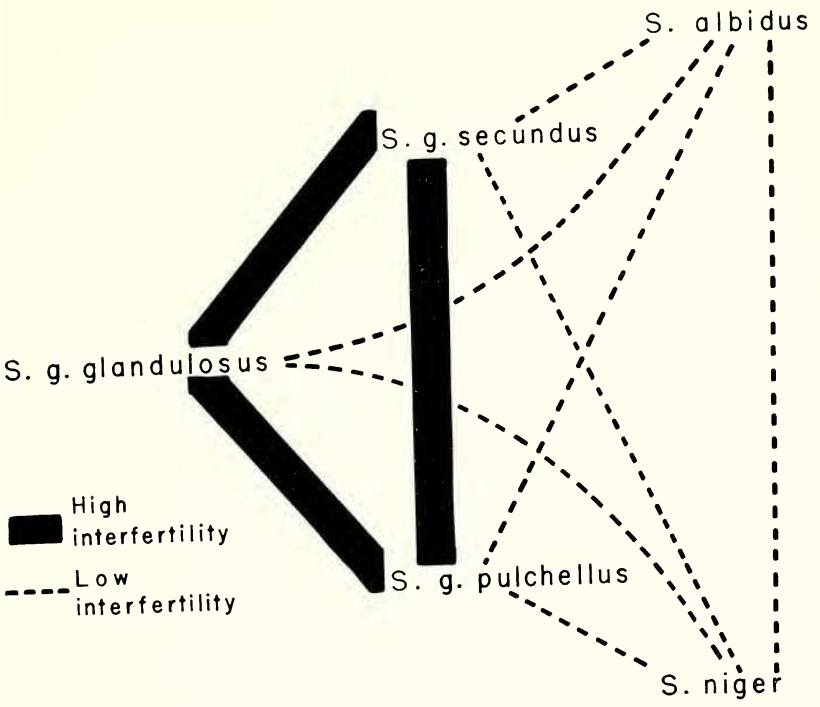

FIG. 1. Summary of the interfertility relationships among the five taxa of the *Streptanthus glandulosus* complex. A synthesis of pollen fertilities from over 300 artificial interpopulational hybrids.

become only slightly smaller towards the terminal flower. Thus the combined features of leaf shape, pubescence, and inflorescence serve to set the complex apart from other "euclisian" streptanthi. All members of the complex have the gametic chromosome number of 14.

A key to the five taxa permits the identification of the majority of populations. It must be recognized, however, that we are dealing with an intricate pattern of variation that appears to be correlated with the spatial isolation of populations (Kruckeberg, loc. cit.). In other words, the discontinuity of suitable habitats has promoted many morphologically distinct populations of a very local occurrence. Thus the eternal dilemma is forced upon us of either having to recognize taxonomically each Mendelian population or abstracting from the total variation pattern only the more salient representations. The latter course has been adopted here as best serving the needs of a practical taxonomy. At the same time attention is called to the fact that certain of the taxa (especially *S. glandulosus* subsp. *glandulosus* and *S. glandulosus* subsp. *secundus*) encompass systems of populations with variable morphology and showing varying degrees of genetic isolation.

KEY TO THE SPECIES AND SUBSPECIES IN THE STREPTANTHUS GLANDULOSUS COMPLEX

A. Plants glabrous throughout; inflorescence simple or branched, forming a "zig-zag" outline; pedicels twice as long as the purplish–black flowers; serpentine outcrops, Tiburon Peninsula, Marin County.....3. *S. niger*

AA. Plants pubescent at least on the basal and lower cauline leaves; inflorescence straight and stiffly erect, simple or branched; pedicels shorter than the flowers.

B. Inflorescence a secund, simple or branched, raceme; Marin County and northward in the outer Coast Ranges to west–central Sonoma County.

C. Sepals greenish–white, white, or yellow (or rarely rose); petals colored like the sepals or veined with rose or purple; inflorescence not crowded; plants usually tall, 3–7 dm. high; usually on serpentine, Marin and Sonoma counties, and possibly discontinuous northward along the outer Coast Ranges to Josephine County, Oregon.....1c. *S. glandulosus* subsp. *secundus*

CC. Sepals reddish–purple; flowers crowded on the short inflorescences; plants usually dwarfish, 1–4 dm. high; on serpentine outcrops, south and east slopes of Mount Tamalpais, Marin County

1b. *S. glandulosus* subsp. *pulchellus*

BB. Inflorescence not secund.

D. Plants robust, 6–10 dm. tall; herbage coarse, often fleshy, glaucous and nearly glabrous; flowers either lilac–lavender or white; usually on serpentine, Alameda, Contra Costa and Santa Clara counties.

E. Flowers greenish-white; on serpentine hills south of San Jose, Santa Clara County.....2a. *S. albidus* subsp. *albidus*

EE. Flowers lilac–lavender; on barren outcrops of various parent materials, Alameda, Contra Costa, and Santa Clara counties.

2b. *S. albidus* susbp. *peramoenus*

DD. Plants smaller, 3–7 dm. tall; herbage green, sparsely pubescent to hispid; flowers lilac-lavender to purple or purplish-black, rarely pale rose; widely distributed mainly on serpentine from San Luis Obispo County north to Tehama County.....1a. *S. glandulosus* subsp. *glandulosus*

1. STREPTANTHUS GLANDULOSUS Hook. Ic. Pl. 1, pl. 40. 1836.

Annual; stems erect, simple or divaricately branched just above the basal rosette, glabrous or sparingly (rarely densely) hispid to the inflorescence; plants densely rosulate at first, basal leaves 5–10 cm. long, hispid, narrowly lanceolate, tapering to a short, winged petiole, coarsely and sinuately toothed to shallowly pinnatifid, the teeth callus–tipped; cauline leaves sessile, auriculate, narrowly lanceolate, remotely toothed, gradually reduced upwards, becoming entire, auriculate, lanceolate-acuminate; by anthesis basal and lower cauline leaves becoming deciduous and stems ultimately naked up to 2–3 nodes below the inflorescence, flowers 0.8–1.2 cm. long, ascending to erect in single to several open, erect racemes; at anthesis flowers on wiry pedicels 1.0 cm. long, spaced at intervals of 4 to 2 cm. from base to apex; sepals glabrous or sparingly hispid, wholly or partly connivent, strongly keeled and collectively umbilicate at base, the calyx thus appearing inflated; petals well exserted; the crisped margins usually white, the upper pair with a broad blade, slightly to strongly recurved, longer than the lower, less recurved and narrower pair; stamens in three pairs, the upper with filaments connate to ½ – ¾ their length, bearing sterile or scarcely polliniferous anthers,

the lower and lateral pair fertile, extending and dehiscing in that order, scarcely exserted; siliques glabrous (or rarely hispid), not torulose, 5–8 cm. long, straight and ascending, or divaricate, to arcuate or sharply reflexed; seeds oblong–oval, winged, 2 – 2.5 mm. long, 1.0 – 1.5 mm. wide; cotyledons accumbent (*fide* F. W. Hoffman).

1a. STREPTANTHUS GLANDULOSUS subsp. **glandulosus.** *S. glandulosus* Hook., Ic. Pl. 1. pl. 40. 1836. Type: *Douglas,* Monterey, California. *Erysimum glandulosum* O. Ktze., Rev. Gen. 2: 933. 1891. *Euclisia glandulosa* Greene, Leafl. Bot. Obs. 1: 82. 1904.

S. biolettii Greene, Pittonia 2: 225. 1892. Type: *Bioletti,* on Hoods Peak in 1889. *Euclisia biolettii,* Leafl. Bot. Obs. 1: 83. 1904.

S. versicolor Greene, Erythea 3: 99. 1895. Type: *Byxbee,* banks of Navarro River in 1894. *Euclisia versicolor,* Leafl. Bot. Obs. 1: 83. 1904.

S. asper Greene, Pittonia 3: 225. 1897. Type: *Greene,* on Mount St. Helena in 1894. *Euclisia aspera,* Leafl. Bot. Obs. 1: 83. 1904.

S. bakeri Greene ex. C. F. Baker, West Am. Plants, 2: 17. 1903. Type: *Baker,* near Bethany on plains of upper San Joaquin, 1903. *Euclisia bakeri,* Leafl. Bot. Obs. 1: 84. 1904.

S. mildredae Greene, Leafl. Bot. Obs. 1: 83. 1904. Type: *Holden,* Mount Hamilton. *Euclisia mildredae,* Leafl. Bot. Obs. 1: 83. 1904.

Euclisia violacea Greene, Leafl. Bot. Obs. 1: 83. 1904. Type: *Palmer,* "somewhere in middle California," 1876; *US 4297!*

Euclisia elatior Greene, Leafl. Bot. Obs. 1: 84. 1904. Type: *Vasey,* Santa Lucia Mountains, in 1880; *US 4295*!

Flowers lilac-lavender to purple or more often purplish-black, rarely rose. n=14.

Type. "Monterey, California," *Douglas* as figured by Hooker (1836). Of the type, E. L. Greene (1904, p. 82) stated: "*S. glandulosus,* Hook . . . , as to original specimens, but figures false. *Streptanthus peramoenus,* Greene, . . . I did not believe that the plant with the remarkably irregular calyx described by me could be that which had been intended by Hooker's figure until I had seen the originals of *S. glandulosus* at Kew. Such falsification of the characters of a species is not publication; and this beautiful plant was truly first described, and therefore published, as *S. peramoenus,* which name ought to be continued in use, and Hooker's supressed as being worse than a *nomen nudum.*" However, Jepson evidently had no misgivings about the Hooker name when he annotated a specimen assigned to one of Greene's many segregates of subsp. *glandulosus* (i.e., *S. biolettii*) as follows: "Identical with *S. glandulosus* Hook.! Compared at Gray Herbarium with the cotype.—W.L.J." (UC 10874).

Range and Variation. The subsp. *glandulosus* constitutes the major element of the species and as such has the most extensive distribution. Within its north–south range from Tehama County to San Luis Obispo County, there may be blocked out areas of morphological homogeneity, although these are not always clear–cut. Plants with large, lilac–lavender

flowers on a thick-set peduncle occur in the southern end of the range—mainly in northern San Luis Obispo County. Northward from Monterey County, the transition is rather abrupt and the inflorescences are typically more delicate, with flowers that are either violet-purple or more commonly purplish-black. The blades of the petals are white along their crisped margins, with the median portion of the lamina veined in violet or purple. South of San Francisco Bay, the dark-flowered form of subsp. *glandulosus* is found chiefly on serpentine in Monterey, Santa Cruz, San Benito, and Stanislaus counties; a very few collections of this form are from southeastern Alameda County in the Bay region. North of the Bay, the distribution of the dark purple-flowered plants is mainly on serpentine outcrops in the mountains and foothills bordering the Great Valley, and occasionally westward to the outer Coast Ranges. This dark-purple form from north of the Bay has been collected most frequently in Napa and Lake counties, and to a lesser extent in eastern Sonoma, Solano, Colusa, Tehama, and Mendocino counties.

Specimens seen. San Luis Obispo County: 3.6 miles northeast of Valencia Peak, *Belshaw 1727* (UC) (17)[2]. Monterey County: granite talus, east side of Henry Sands Canyon road, Gabilan Range, *2772* (UC) (5). Santa Cruz County: Charmichael's Mill, Santa Cruz Mountains, *Pendleton 943* (UC) (1). San Benito County: trail above weather station, Pinnacles National Monument, Paicines, *Burgess 172* (UC) (1). Stanislaus County: Del Puerto Canyon *Hoover 3374* (UC) (3). Santa Clara County: Copernicus Peak, Mount Hamilton, *Sharsmith 1287* (UC) (14). Alameda County: Mocho Creek, *Elmer 4415* (UC) (2). Sonoma County: serpentine along ridge-top above Pine Flat and near Contact Mine, *Hoffman 2902* (UC) (8). Napa County: Pope Creek bridge south of Walters Springs, *Keck 2370* (UC) (11). Lake County: oak forest, Bartlett Mountain, 4 miles from Lucerne, *Mason 11747* (UC) (24). Solano County: Weldon Canyon road north of Vacaville, *Gould 262* (UC) (3). Colusa County: grade on Rumsey-Arbuckle road, *Hoover 3205* (UC) (4). Mendocino County: serpentine talus 0.9 miles west of Hopland, *Hoffman 2274* (UC) (4). Tehama County: 5½ miles west of Paskenta in foothills near a burn, *Baker 12539* (UC) (1).

1b. STREPTANTHUS GLANDULOSUS subsp. **pulchellus** (Greene) Kruckeberg hoc loc. *S. pulchellus* Greene, Pittonia 2: 225. 1892. Type: *Howe,* dry ridges on the southern flank of Mount Tamalpais, 1892. *Euclisia pulchella,* Leafl. Bot. Obs. 1: 83. 1904. *Streptanthus glandulosus* var. *pulchellus* Jepson, Man. Fl. Pl. Calif. 420. 1925.

Plants often dwarfish, 1–4 dm. tall, flowers reddish-purple, usually secund, crowded on the short, simple to branched racemes; siliques divaricate or ascending, 4–6 cm. long. n = 14.

---

[2] One specimen for each county is cited; the total number seen from a given county is given in parentheses.

Range and Variation: Subspecies *pulchellus* is confined to serpentine outcrops on the slopes of Mount Tamalpais, Marin County. The combination of dwarfish stature, purple flower color and secund inflorescence serves to distinguish subsp. *pulchellus* from the other subspecies. It is, however, highly interfertile with the Marin County populations of subsp. *secundus,* as well as with certain Napa and Lake County populations of subsp. *glandulosus.* Two other species of the section Euclisia occur in Marin County. With *S. niger,* subsp. *pulchellus* is both spatially and genetically isolated. With the equally narrow endemic, *S. batrachopus* Morrison, it is sympatric, but as yet no attempt has been made to cross these two very different plants.

Specimens seen. Marin County: Large serpentine outcrop between Mountain Theater and the toll road, Mount Tamalpais, *Morrison 3103* (UC) (21).

1c. Streptanthus glandulosus subsp. **secundus** (Greene) Kruckeberg hoc loc. *S. secundus* Greene, Fl. Fran. 261. 1891. Type: *Greene,* north base, Mount Tamalpais, 1886. *Euclisia secunda* Greene. Leafl. Bot. Obs. 1:83. 1904.

Flowers in open or crowded secund racemes; siliques usually arcuate, 5–6 cm. long.

1d. Streptanthus glandulosus subsp. secundus var. **secundus.** *S. secundus* Greene, Fl. Fran. 261. 1891. *Euclisia secunda* Greene, Leafl. Bot. Obs. 1:83. 1904. (*Greene,* north base, Mount Tamalpais.)

Flowers greenish-yellow, tinged with rose or purple as blotches at the base of the sepal and on the veins of the petal lamina. n = 14.

Range. Mostly on serpentine, north side of Mount Tamalpais and the adjacent grassy or chaparral-covered hillsides of Marin County.

Specimens seen. Marin County: Serpentine slope at head of Lucas Valley, *Howell 13945* (WTU) (13).

1e. Streptanthus glandulosus subsp. secundus var. **sonomensis** Kruckeberg hoc loc. *Hoffman 2323* (UC 985963) serpentine, Great Eastern Quicksilver Mine, near Guerneville, Sonoma County, June 8, 1948.

Floris luteis vel viridio-alba vel alba.

Flowers yellow, white or greenish-white. n = 14.

Range. On serpentine or other ecologically similar sites in central Sonoma County, ranging from the eastern border of the county (west end of Knight's Valley) to Cazadero in the western section of the county.

Specimens seen. Sonoma County: 3 miles south of Monte Rio on road to Camp Meeker, *Hoover 5084* (UC) (24).

1f. Streptanthus glandulosus subsp. secundus var. **hoffmanii** Kruckeberg hoc loc. *Constance 2155* (UC 614606) moist soil of steep, rocky, nonserpentinized bank with *Umbellularia* and *Aesculus* at edge of Sequoia grove, 400 feet altitude, Russian Gulch, 8 miles south of Fort Ross, Sonoma County, April 24, 1938.

Floris roseis vel roseo-purpureis.

Flowers rose to rose-purple. n = 14.

Range. Open, rocky slopes of either serpentine or non-serpentine parent material. Known from only the type locality and Red Slide at the headwaters of Austin Creek, both areas just back of the wooded ridges along the coast.

Specimens seen. Sonoma County: serpentine, Red Slide at headwaters of East Austin Creek, *Hoffman 2343* (UC) (3).

Range and Variation of subsp. *secundus*. Subspecies *secundus* occupies a well-defined territory extending from the north side of Mount Tamalpais, Marin County, north throughout most of Sonoma County. The flowers of the Marin County plants (var. *secundus*) have greenish-white calyces and yellowish petals, but with both sets of parts prominently veined with violet, while the flowers of the Sonoma County plants (var. *sonomensis*) are either pure yellow or greenish-white. The center of distribution of subsp. *secundus* appears to be just north and south of the Russian River around Guerneville, where it occurs predominantly on serpentine, as var. *sonomensis*.

The rose-colored plants (var. *hoffmanii*) have been collected only rarely in the little explored Russian Gulch-Austin Creek areas north of the Russian River. The collections of the enthusiastic *Streptanthus* specialist, Freed W. Hoffman, of Guerneville, have added materially to our knowledge of the flora of this little known region. Variety *hoffmanii* has the most delicate inflorescences of all the forms of *S. glandulosus,* a character easily singled out in garden cultures where it can be compared with the inflorescences of plants from other populations. As was pointed out in Kruckeberg (1956), the high interfertility of this form with Sonoma and Lake County plants of both subsp. *glandulosus* and subsp. *secundus,* make it difficult to place these rose-colored populations in one or another of the subspecies. The secund inflorescence and the distribution of the variety justify its alliance with subsp. *secundus* here.

The recognition of two regional facies of the subspecies, one in Marin County (var. *secundus*) and the other in Sonoma County (var. *sonomensis* and var. *hoffmanii*), is supported by the fact that interpopulational hybrids between plants from the two areas are less fertile than those involving populations within the two areas.

Populations in Josephine County, Oregon, which are readily referrable to the *S. glandulosus* complex, are, nevertheless, anomalous in their relation to subspecies *secundus* and *glandulosus*. These plants from Oregon most resemble the Marin County variety of subsp. *secundus*. Yet the gap in distribution of subsp. *secundus* between even the northern Sonoma County plants and the southern Oregon ones is both absolute and wide. Hybrids between the Oregon plants and plants of Californian *S. glandulosus* do not clarify the affinity of the Oregon plants to one or another of the three subspecies, since exceptionally fertile hybrids have been obtained in a number of these crosses. The taxonomic position of the Oregon plants

will remain in doubt until collecting of streptanthi throughout the serpentines of northern California and southwestern Oregon is intensified and until the fertility of the appropriate interpopulational hybrids is evaluated.

2. STREPTANTHUS ALBIDUS Greene, Pittonia 1:62. 1887.

Habit similar to *S. glandulosus,* but usually taller (6–10 dm. high), stout, tending to be fleshy and glaucous throughout; rosette leaves sinuately dentate, callus-tipped, sparsely pubescent, or more commonly, glabrous, broadly linear-lanceolate, 9–12 cm. long; cauline leaves similar but gradually shorter upwards, saggitate-clasping; flowers large, 1.4 cm. long (between distal ends of reflexed upper and lower petals) and 1.7 cm. wide; petals strongly recurved, the margins of the blade crisped and usually white; siliques straight, stiffly and divaricately ascending, 6–8 cm. long; seeds as in *S. glandulosus.*

2a. STREPTANTHUS ALBIDUS Greene susbp. **albidus** *S. albidus* Greene, Pittonia 1:62. 1887. Type: *Rattan,* hillsides four miles south of San Jose, in 1887. *Euclisia albida,* Leafl. Bot. Obs. 1:83. 1904. *S. glandulosus* var. *albidus* Jepson, Man. Fl. Pl. Calif. 419. 1925.

Sepals greenish white, tawny purple-tinged at base. n = 14.

Specimens seen. Santa Clara County: Metcalfe Canyon, 1¼ miles northeast of Coyote, *Sharsmith 3956* (UC) (8); photograph of isotype seen.

2b. STREPTANTHUS ALBIDUS Greene subsp. **peramoenus** (Greene) Kruckeberg hoc loc. *S. peramoenus* Greene, Bull. Torrey Club 13:142. 1886. Type: *Bolander,* in Oakland Hills.

Sepals lilac-lavender. Plants tending to be less robust than subsp. *albidus.* n = 14.

Specimens seen. Alameda County: Oakland Hills, *Michener & Bioletti 672* (WTU) (5). Contra Costa County: 2 miles outside the north entrance to Mount Diablo State Park, *Morrison* and *Constance 3030* (UC) (7). Santa Clara County: 0.3 miles southwest of Madrone, *Belshaw 16167* (UC) (2).

Range and Variation of Species. *Streptanthus albidus* occurs on serpentine and ecologically similar sites in Alameda, Contra Costa and Santa Clara counties. Its robustness, the glabrous and glaucous herbage, combined with the flower color are its marks of distinction. It is here taken to include two distinct color variants. The lilac-lavender flowered subsp. *peramoenus* is found in the Oakland-Berkeley Hills, Mount Diablo, the hills above Sunol and the ridges of western Santa Clara County (e.g., upper Stevens Creek). Subspecies *albidus*, with greenish-white flowers is confined to the serpentine foothills south and east of San Jose around Coyote and Madrone. The two subspecies are fully interfertile and yet both are genetically isolated from all other members of the *S. glandulosus* complex.

3. Streptanthus niger Greene, Bull. Torrey Club 13:141. 1886. *Euclisia nigra,* Leafl. Bot. Obs. 1:83. 1904. Type: *Greene,* Point Tiburon, 1886.

General habit of *S. glandulosus*; herbage glabrous, glaucous-green throughout; plants simple or branched above the base, 2–8 dm. high; basal leaves lanceolate in outline, pinnately lobed, 5–7 cm. long; inflorescence open, the rachis "zig-zag"; pedicels 1.4–2.0 cm. long, twice as long as the flowers; sepals purplish-black with a distinct metallic cast, 0.7 cm. long; calyx appearing inflated, umbilicate based, the sepals strongly carinate; petals linear, the margins white and crisped, the median portion of the lamina veined purplish-black, exserted only 2–3 mm., barely reflexed; filaments of the upper pair of stamens connate almost throughout, their anthers wholly sterile; lateral and lower pairs of stamens barely exserted, crowded in the contracted throat of the corolla, through which the flat capitate stigma is forced; siliques stiffly ascending, straight, 5–6 cm. long; seeds oblong to oval, narrowly winged, 1.6–1.8 mm. long. n = 14.

Range and Variation. *Streptanthus niger* has never been found elsewhere than the type locality, on the southern tip of Tiburon Peninsula, Marin County, an area of not more than a square mile in extent. The plant is found in draws, slopes and ridges of the hilly area of the peninsula just above the narrow Raccoon Straits between the peninsula and Angel Island. The entire area is of stony, shallow soil derived from serpentine rock, and apart from the wholly barren spots, supports a varied and rather dense herbaceous vegetation, with only a very few and widely separated specimens of stunted *Umbellularia* and *Quercus*. The single population of *S. niger* is made up of small, semi-isolated colonies, with no apparent variation within or between colonies. It may well be, then, one of the most narrowly restricted species in the Californian flora.

As shown in figure one, hybrids between *S. niger* and any other member of the complex have been sterile. Thus, genetic isolation is complete between *S. niger* and even the most likely relatives of the species such as *S. glandulosus* subsp. *pulchellus* which grows on nearby Mount Tamalpais, or *S. albidus* subsp. *peramoenus* which occurs in the Berkeley Hills just across San Francisco Bay.

Specimens seen. Marin County: Rocky serpentine soil, Tiburon, *Raven 843* (UC) (6).

Close relationship between the *S. glandulosus* complex and other streptanthi may be sought among other members of the section Euclisia, particularly the so-called "color-spot" species, aptly delimited by Morrison (1941) as the subsection Insignes (in his unpublished thesis). Hybrids between one of the Insignes group (*S. insignis* Jeps.) and *S. albidus* were quite fertile. *S. hispidus* Gray, another member of the Insignes group, appears to be related to *S. glandulosus* subsp. *pulchellus*. The author intends to expand the interfertility studies in *Streptanthus* to include other species of the genus, especially those in the section Euclisia.

Acknowledgements.—The author wishes to express his gratitude to two *Streptanthus* specialists, Mr. Freed W. Hoffman and Dr. John L. Morrison, for their continued advice and criticisms. Dr. C. Leo Hitchcock kindly read the manuscript. Thanks are due also to the curatorial staffs of the University of California and the United States National Herbarium for loans of specimens.

Department of Botany
University of Washington
Seattle 5, Washington

Literature Cited

Abrams, L. R. 1944. Illustrated flora of the Pacific States. Vol. II. Stanford University Press, Stanford, California.

Eastwood, Alice. 1931. New species of plants from western North America. V. Proc. Calif. Acad. Sci., Ser. IV; 20:135–160.

Greene, E. L. 1904. Certain West American Cruciferae. Leafl. Bot. Obs. and Crit. 1:81–90.

———. 1906. Four streptanthoid genera. Leafl. Bot. Obs. and Crit. 1:225–229.

Hooker, Wm. J. 1836. Icones Plantarum, 1. t. 40.

Jepson, W. L. 1925. A manual of the flowering plants of California. Associated Students Store. Berkeley, California.

———. 1936. A flora of California. Vol. II. Associated Students Store. Berkeley, California.

Kruckeberg, A. R. 1957. Variation in fertility of hybrids between isolated populations of the serpentine species, Streptanthus glandulosus Hook. Evolution 11: 185–211.

Morrison, J. L. 1941. A monograph of the section Euclisia Nutt., of Streptanthus Nutt. Unpublished Ph.D. Thesis. University of California, Berkeley.

STUDIES OF THE POLLEN GRAIN AND POLLEN TUBE IN CERTAIN MALVACEAE

R. M. Datta

The pollen grains of all Malvaceae in which they have been studied are round with spinescent outgrowths of varying shapes and lengths distributed uniformly on the exine wall (Wodehouse, 1935; Zander, 1935; Lang, 1937; Erdtman, 1952). A varying number of roundish conspicuous apertures is distributed evenly upon the exine surface. Concerning these apertures, Wodehouse (1935) remarks, "Though their shape and their function of serving as places of exit for the pollen tube prompt us to call them germ pores, there is much evidence to show that such apertures are morphologically furrows, which have become so shortened that they coincide in extent with their enclosed germ pores."

Amici (1830), the discoverer of the pollen tube, recorded polysiphonous germination of the pollen grain in *Hibiscus Trionum* and *H. syriacus;* in the latter species, some grains gave rise to twenty to thirty tubes. Guignard (1904) corroborated him after *in vivo* studies of *H. Trionum,* and found that only one tube plays a part in fertilization. Stenar (1925) found